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APPEAL

The Department of Environment, Government of India, has given us a two years assignment (1985-87) for writing an illustrated reference book on the Asiatic Lion (*Panthera leo persica*). The book will be in two parts, viz. (A) The Asiatic Lion in the wild, and (B) in captivity. We shall be grateful to receive from readers any authentic information/observations/research data/interesting anecdotes and outstanding photographs/transparencies concerning this feline species, its habitat and associated fauna (particularly the prey animals), Gir maldharis, etc. for including in our book which will be brought out as a Government publication. The source of all material accepted for publication will be duly acknowledged. Photographic material could even be purchased outright if the owner so desires. Material/correspondence may please be sent at the following addresses:-

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Goodbye Corbett, Welcome Shikar Academy

Hugh & Colleen Gantzer

CORBETT National Park is doomed. One of the most beautiful natural resources of India, and the world's first Project Tiger reserve, is about to die. But this time our oft-maligned industry is not responsible; nor is it the doing of the loggers or the quarriers or the high-rise property developers. The blame must rest squarely on the shoulders of the consistently short-sighted U.P. Government.

We will, however, give Vir Bahadur Singh's Cabinet the benefit of the doubt. We shall not accuse anyone of deliberately plotting the commission of an ecological and environmental crime. We shall presume that whatever has been done has been done in ignorance, and that once the Chief Minister knows the facts of the case he will reverse this ill-conceived decision.

Here, then, are the facts of the case:

According to the official brochure of the Park, produced by the Forest Department of Uttar Pradesh: 'Corbett is India's first National Park and one of the finest, notable for its individualistic scenic charm and magnificent sub-montane and riverain vistas, and also for its richly varied wildlife, still interestingly in the process of change, and the site of the launching of Project Tiger. In recent years the Ramganga Multi-purpose Hydro-Electric Project's dam at Kalagarh (the largest earth dam in Asia) and the reservoir of this dam have had a marked influence on the Corbett reserve.'

The reservoir, which spreads across the western boundary of the Park, often floods as much as one-tenth of the 521 square kilometres of the reserve. But this is not the only effect of the dam. More important is the fact that when the dam was being constructed, a large tract of the National Park's land was given, temporarily, to the State's Irrigation Department to house the dam workers, their stores and equipment. And, as often happens when one department acquires the property of another, no steps were taken to return this land to the National Park once the dam had been completed.

Today, that enclave stands as a continuing threat to the environmental integrity of the Park.

Shortly, however, it will cease to be a mere threat. In a few months from now it will become a festering sore of repeated aggression against the Park.

On the 23rd of December, 1985, at a meeting of the U.P. Cabinet, decision was taken to transfer this land to the Home Department of the State. On the 31st of January, this

year, remarkably fast for the normally lethargic U.P. bureaucracy, the Home Department asked the Irrigation Department to hand over these lands.

It is possible that the U.P. Cabinet does not know that its decision violates the Wildlife Protection Act and the Forest Conservation Act. The latter Act, in particular, specifically prohibits any National Park land from being used for any other purpose than the preservation of wildlife.

For even though the police have not, as yet, been classified as wildlife, the Home Department of the U.P. in one of the most remarkably inept decisions in its already remarkable record of bumbling, intends to build a Police Academy in Corbett National Park.

Thus, there is the unenviable prospect of 2,000 raw policemen trampling all over the Park, terrorising the Forest Guards, poaching and learning how to deal with encounters with dacoits by firing innumerable rounds of ammunition, day after day, year after year, endlessly.

And no one makes a more implacable and lawless poacher than a policeman: as the protectors of the Corbett Park have learnt to their dismay.

On the 2nd of January 1982, Brijendra Singh who is the present honorary Wildlife Warden of the Park, a gentleman from Holland and Trevor Fishlock of the London Times, heard two shots in the Park. They suspected that these shots came from a launch which they had spotted approximately 500 metres away from them. According to the statement of one of the people in Brijendra Singh's party: 'We moored our boat in front of the launch and disembarked and approached the launch. Four male adults in civilian clothes were seated in the forward compartment of the launch and with them were two teenaged boys, three children and two ladies. One of the men was holding a single barrelled short gun while another was armed with a handgun in a holster. At the rear of the boat stood a man in police uniform also armed with a revolver, while beside him stood another man who Mr. Brijendra Singh recognised as the operator of the launch, he being known to him from previous trips to the National Park.

The men holding the shot gun denied that any shooting had taken place and then advised the others in the launch not to identify themselves. When Brijendra Singh went into the forest to see if any animal had been injured in the shooting, the main spokesman of the shooting party identified himself as the District Magistrate of Bijnor. He identified the others as the SDM of Nagina, the Divisional Commissioner of Moradabad, the Superintendent of Police of Bijnor, the Station House Officer of Kalagarh, and various family members of the above officers. The DM assured Brijendra Singh's party that Brijendra Singh would not find any clues as no animal had been shot or aimed at.

The statement goes on to say: Both the SDM and DM were rather consternated when the search party returned in about 15 minutes with leaves and grass on which were smears and drops of fresh blood.

Brijendra Singh reported the case to the Forest Department officials who recorded everyone's statements and confiscated the shot gun.

After which all in the shot gun party were released, allowed to board the launch and proceed in the direction of Kalagarh. They had come from the Irrigation Department's enclave, across the unpatrolled waters of the reservoir.

The launch belonged to the Irrigation Department. The gun belonged to the Superintendent of Police. The administration of justice belonged to the Divisional Commissioner, the DM and the SDM.

The case was investigated departmentally, which in bureaucratic parlance, means that no witnesses could be compelled to attend, no evidence was given under oath, no witnesses were required to sign their statements, no lawyers were permitted to be present to ensure that justice was being meted out in accordance with law. When public interest groups started getting interested in this case, they were assured that the government had the situation firmly in hand and that there would be no need to seek legal remedies.

Eventually no one was punished and it is unlikely that any of the government servants in the gun-totting party got anything even so mild as an adverse notation in a personal file.

They were all treated as truant school children who had erred in being caught in a very minor peccadillo.

But the forest officials recall all this with apprehension. As one of them put it: "They accuse us of corruption. But we at least can be tried and punished. Who tries and punishes those who, themselves, are responsible for trial and punishment? Who will rectify the Fence which Eats the Crop? Who will stop Kalagarh from becoming an open gateway to shikar in Corbett?"

Kalagarh, we would like to remind you, is where the U.P. Government wants to establish a Police Academy.

Goodbye Corbett. Welcome Shikar Academy!

Courtesy Hindustan Times

Note:-

We urge our readers with all possible emphasis to write to the Chief Minister, Uttar Pradesh to reconsider his decision to locate the Police Academy at Kalagarh on Corbett Park land and to choose an alternative site well away from the vulnerable Park.

Editor

On the Trail of Fishing Cat

P. SANYAL AND S. ROY

The Cat Group of the Species Survival Commission of the International Union for Conservation of Nature and Natural Resources recommended in April, 1983, during a Symposium on Cats held at the Kanha National Park, that lesser cats should be studied in more details in India.

Sunderbans of India, a mangrove tiger land is also a favourite habitat of Fishing Cats (*Felis viverrina*) along with the occasional occurrence of Jungle cat (*Felis ehaus*). It is well known that man-animal confrontation occurs in Sunderbans so far as tiger is concerned. Similarly lion and leopard also confront man in other parts of India and abroad. But among the lesser cats it is only the fishing cat, deriving its name from Bengali version "Machh Beral" which is known to confront human beings too (Guggisberg C.A.W. 1975). The population status of this species in the Sunderbans is approximately 500 Nos. distributed in the outer estuarine zone (20 km away from sea face) and inner estuarine zone (60 km away from seaface). This lesser cat is conspicuously absent in the mid estuarine tract. There have been occasional reports of child lifting by these fishing cats. While the author was visiting a plantation at Marich-Jhapi in 1981, a dumbstruck girl of around 12 years of age was rescued by her mother, a plantation labourer. It was reported that the girl was attacked by a tiger and the mother rescued her. But on verification of the pugmark it was ascertained to be not a tiger but a fishing cat.

A special study programme was undertaken on fishing cats in the Sunderbans Tiger Reserve. Baiting for fishing cat was started within forest at two locations viz: Marich-Jhapi and Sajnakhali from November 1984. Chicken bait was placed and in Sajnakhali a competition was noticed with giant water monitor (*Varanus salvator*). Therefore a 75 cm high rostrum of brush wood was made. On it the chicken was placed and the competition was avoided. At Marich-Jhapi, however, such a competition was not noticed but a tiger ate away the bait on 15.1.85. From January 1985 onwards baiting pattern was changed and fresh water fish was provided as bait. It was noticed that carps like Labeo species were not favoured. On trial and error method, the most favoured bait was found to be the lesser Mullet (*Mugil persia*). Next preference was found to be the Silver carp fish which is equally dazzling white in appearance.

At Marich-Jhapi the frequency of visit was found to be inversely proportional to the visit of tiger. It was also dependent on lunar position. During the neap tide period more frequent visits of the cat was found, possibly due to difficulty in treading through soft mud banks to approach water area for natural hunting of fish.

Breeding Behaviour:

At the Marich-jhapi observation point continuous monitoring of pug-marks revealed that there is a distinct differentiation in the size of the pug-marks. Most frequent pug-mark length was found to be 4.1 to 4.5 cm group and the largest size was 5.6 to 6 cm which contains about 15% of the pug-marks. This is a possible indication of difference of male and female pug-mark sizes. Pairing was noticed on 28th February and 1st March 1985. From 23.4.85 pug-mark of the female was not found for about a month. On 20.5.85 a female was located on the other side of the river at Bagna village carrying two kittens on her mouth. She might have left the forest tract to ensure safety of the new born from predation. The female dropped one kitten which was collected on 20.5.85. The kitten was a female, about 15 day old with clear vision. Its length was 27 cm and weight 550 gm. On 22.5.85 and 23.5.85 trip photographs were taken at night. Photo of a large fishing cat was obtained on the first night. From the pug-marks it appeared that two cats visited the spot—one having pug-mark length 3.9 cm and another with 4.4 cm. On 23.5.85 trip photographs revealed a fishing cat of a smaller size—possibly a female one with pug-mark length 3.9 cm.

In May, 1981 a kitten of a fishing cat was recovered from Jhilla block within annual felling coupe by the Coupe Officer. On inspection it was found to be less than 7 days old and eyes had not opened. Weight was measured to be 400 gm. After rearing for two months the kitten died of Rabies which is possibly endemic in the cat population in Sunderbans.

From the above observations it appears that mating takes place in March and gestation period is 60-70 days. Guggisberg (1975) mentioned that the gestation period is nearly 63 days in captivity.

Growth Studies:

The kitten which was rescued in the year 1981 was about 7 days old and had not developed proper vision. The weight was measured to be 400 gm. Detailed study was not made. Amul whole milk mixed with water was given as the food. It did not relish fish afterwards.

Fishing Cat Male/Female Datewise Log of Length of Pugmarks

Date	3.1 cm to 3.5 cm	3.6 cm to 4 cm	4.1 cm to 4.5 cm	4.6 cm to 5 cm	5.1 cm to 5.5 cm	5.6 cm to 6 cm
1	2	3	4	5	6	7
30.12.84			1			
15.1.85			1			
16.1.85			1			
22.1.85			1			
24.1.85			1			
25.1.85						1
27.1.85						1
28.1.85					1	
4.2.85					1	
7.2.85				1		
8.2.85				1		
25.2.85					1	
26.2.85				1		
28.2.85				1		
1.3.85				1		
15.3.85			1			
16.3.85		1				
17.3.85			1			
18.3.85		1				
29.3.85			1			

(Contd.)

1	2	3	4	5	6	7
2.4.85			1	1		
4.4.85			1			
5.4.85		1				
6.4.85				1		
7.4.85				1		
8.4.85			1			
11.4.85	1	1				
16.4.85		1				
17.4.85	1					
18.4.85		1				
20.4.85		1				
23.4.85						
7.5.85				1		
8.5.85						
9.5.85						
12.5.85					1	
13.5.85		1				
17.5.85		1				
20.5.85					1	
22.5.85		1	1			
23.5.85		1	1			
14.6.85					1	
24.6.85			1			
1.7.85						1
	2	11	14	9	6	8

The one which was rescued on 20.5.85 at Bagna was kept under detailed study. The diet consisted of 100 cc of Amul-spray milk with 2 drops of A.B.D.E.C. vitamin in the morning and two boiled lesser mullets weighing 100 gm twice a day. After two weeks one live lesser mullet weighing 50 gm was added to the menu twice a day. The following is the growth chart:

Growth Chart of the Kitten

Date	Length (nose to tail)	Weight
20.5.85 (Approx. 15 days old)	27 cm	550 gm
5.6.85	43 cm	650 gm
13.8.85	56 cm	1500 gm

Conclusion

A chart of pug-marks obtained on date-wise log at Marich-jhapi Observation Centre is annexed which would reveal the variation of the length of the pug-marks of the visiting fishing cats. Over 5 cm length group appears to indicate the males. Photographs show a darker and a lighter coat for different fishing cats.

The report of Dr. A.K. Mukherjee of Zoological Survey of India (1980) about extinction of fishing cat in Sundarbans is disproved by this study. Further studies are being conducted.

Acknowledgements

Keen interest of Sri P.K. Mullick Chowdhury, Range Officer, Research Range, Sundarbans Tiger Reserve could make the initial studies fruitful. The help of W.W.F./India—Eastern Region for making available the trip photographic equipment used in the study is gratefully acknowledged.

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Lesser Cats in Madhya Pradesh (India) : Status Report and Suggestions for Their Preservation

By

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We are very familiar with domestic cat, both as a pet and a nuisance. The domestic cats and the wild varieties are all primarily carnivorous and known as beasts of prey and in the food chain, they are termed predators, a role in which they are ecologically beneficial to the man by reducing the herbivorous animals which are in keen competition with man as far as food is concerned.

In case of large members of the family Felidae, it has been universally recognised that they start threatening human habitation, live-stock as well as man's life under pressure of starvation primarily due to lack of natural food and sometimes as a result of injuries received in the struggle for existence or at the hands of men.

The exact cause of the origin of practice of killing of the cats by man is believed to be a mixed reaction to protect our live-stock and to keep memento. In modern times the urge to collect mementos appear to have taken precedence over the protection of live-stock to such an extent that man began killing these animals wantonly and a situation has reached that saner members of our society are alarmed with the prospect of these magnificent creatures becoming extinct and considering the ways of preventing such an eventuality. Some of these animals are perilously on the verge of extinction unless some quick and effective measures are adopted.

Periodically experts have been meeting under the banners of State and Indian Board of Wild Life, Zoological Survey of India, public organisations like Bombay Natural History Society, Wild Life Preservation Society of India, Zoological Society of India, in addition to international organisations like International Union for Conservation of Nature and Natural Resources (IUCN), World Wildlife Fund (WWF), etc. to review the status of wildlife and devise, suggest and implement the means to protect the wildlife including these cats. As a result we have many projects all over the world. In India, we are very familiar with the Tiger Project.

Once the larger game became scarce, man turned his attention to the lesser cats which have by now already become scarce to attract the attention of the world community.

Here we are giving the details of the lesser cats which either once existed in Madhya Pradesh or are still existing but rarely meeting our eyes. The available record shows that five below mentioned lesser cats come under this category.

1. *Felis caracal* Schreber

(The Caracal)

Size: Head and body a little over 60 cm; tail about 23 cm.

Distinctive Characters: It is of lighter build, has broad head, triangular ears with a long tuft on the tip of the ear. Forelimbs smaller than hindlimbs. No ruff on face. Reddish sandy grey coat and white furry belly. Faint indications of spots on the undersurface and sometimes on the back.

Distribution: Only one subspecies *F.c. caracal* found in Madhya Pradesh, Northern and Western India extending further westward outside India.

Habits and habitat: Lives in semi-arid, open bushy and grassy plains, low scrubby hillocks, scattered forested country and sandy deserts.

Status: Endangered (Precarious).

2. *Felis rubiginosa* Geoffroy

(The Rustyspotted Cat)

Size: Head and body 41-46 cm; tail 24 cm.

Distinctive Characters: Half or three-quarters the size of a domestic cat. Slightly built and active. Fur short and soft, soft brown bars and spots arranged more or less in regular lines.

Distribution: Generally considered to be south Indian species, occurring in Western Ghats of Maharashtra, Tamilnadu and Sri Lanka, but recently in the CITES report (1981) The Director, Zoological Survey of India has included Madhya Pradesh and Jammu in its domain. Sterndale (1884) reports taming to kittens in Seoni district (Madhya Pradesh) during 1859-60.

Habits and habitat: Inhabits grass-land, scrub and jungles, and is to some extent arboreal in habits. Litter consists of two or three.

Status: Rare.

3. *Felis libyca* Forster

(The Desert Cat)

Size: Head and body 60 cm; tail 30 cm; weight 3-4 kg.

Distinctive Characters: Pale yellowish fur, infused with grey and marked with black spots. Two horizontal stripes on cheek. The terminal half of its tail is ringed with black.

Distribution: The deserts of north-western India extending into drier parts of Central India. Westward the range extends through desert lands from Sind to northern Africa. Northwards into the steppes of Central Asia.

Habits and habitat: Lives in desert and scrub jungles, and preys on rodents and birds.

Subspecies in Madhya Pradesh: *F. l. ornata* Gray. Pocock (1939) examined material collected from Sehore, etc. in addition to localities in Gujarat and Rajasthan.

Status: Scarce.

4. *Felis chaus* Guldenstaedt

(The Jungle Cat)

Size: Head and body 60 cm; tail about 30 cm; weight 5-6 kg.

Distinctive Characters: Legs long, tail less than half the head and body, less than twice the length of hind foot. Yellowish to sandy grey and unspotted. Lower parts white. A dark stripe from eyes to the muzzle. Ears slightly tufted.

Distribution: The Jungle Cat is found over a wide range from North Africa to South-Western Asia, India, Sri Lanka and Burma. Four subspecies viz., *affinis* Gray, *prateri* Pocock, *kelaarti* Pocock and *kutas* Pearson are found in India and the last named found in Madhya Pradesh. A specimen of *F. c. kutas* collected in Mandla District in 1963 is exhibited in the museum of the Central Regional Station, Zoological Survey of India, Jabalpur.

Habits and habitat: Frequents jungles and open country alike. Causes much damage to small games of all kind, and poultry near human settlements.

Status: Vulnerable.

5. *Felis bengalensis* Kerr

(The Leopard Cat)

Size: Head and body, just under 60 cm (Prater, 1948) but just over 60 cm (Director, Z.S.I. 1981); tail exceeds half the length of head and body; weight 3-4 kg.

Distinctive Characters: About the size of the domestic cat with rather longer legs. Body yellowish above, white below, ornamented throughout with black or brownish spots. Spots usually arranged to form regular lines along the body, may coalesce into uninterrupted longitudinal bands. Four more or less distinct bands running from the crown over the neck and break up into bars or spots on the shoulders. A pair of horizontal cheek stripes.

Distribution: Forested areas from Kashmir and the Himalayas to Cape Comorin. There are three subspecies *bengalensis* Kerr, *horsfieldi* Cray and *trevelyani* Pocock in India but Pocock (1939) thinks that only *bengalensis* is found in Peninsular India including Madhya Pradesh. A specimen of *F. bengalensis* is exhibited in the museum of the Central Regional Station, Zoological Survey of India, Jabalpur. Interbreeding of this species with domestic cats has been reported by Prater (1948).

Habits and habitat: Due to nocturnal habit seldom seen.

Status: Scarce, chiefly due to destruction of its habitat.

Causes of decline of felid population.

This matter has been very widely discussed. It is seen that the causes of decline of cat population fall in two broad categories given below:

1. Developmental activities, and
2. Poaching

Developmental activities:—

The developmental activities include clearing of forests for cultivation, hydro-electric and irrigation projects, mining, construction of transport and communication systems and habitation. India, being a developing country, can not afford to altogether stop the implementation of its industrialization and other welfare projects. The rising population demands more areas to be brought under cultivation which needs greater irrigation facilities which in turn require additional land for storage and transportation of water through canals. The hydro-electric projects are also reducing forest area.

India, like any other country, needs about 33% land area under forests to keep them in good health but we have only about 13% forested land. This imbalance is being aggravated by an estimated loss of 45 million hectare of forest in the last 30 years.

Reduction in forest cover deprives the wildlife of their natural habitat and provides easier accessibility to deeper parts of the remaining forest thus making poaching a flourishing job and it increases the threat to wildlife.

Suggestions for Conservation

Madhya Pradesh is the richest state in the matters of forest wealth having 37.5% land with an area of 1,66,160 sq. km under forest out of a total of 4,42,840 sq. km, but it is no exception to the process of depredation of forest. In order to replenish the forest cover various states have been launching afforestation programmes for the last many years. The success of afforestation schemes should not be assessed by the simple data being doled out by forest departments regarding the number of saplings planted as these data are sometimes misleading. The criterion for success of afforestation schemes should be the survival rate of saplings planted, additional area brought under forest cover and the healthy growth of trees planted since it is ultimately the increase in the number of trees which is the finality we and the wildlife are concerned with. It is common sight that in the lack of subsequent care and watering facilities most of the saplings are either consumed by herbivorous animals or die their natural (strictly speaking unnatural) death. Therefore our emphasis should be not on the number of saplings planted but their better survival rate. World Bank has sanctioned Rs. 100 crores for afforestation schemes. This amount should be well utilized to meet the challenging task before our forest authorities who are also endowed with the responsibility of being the custodians of our wildlife heritage.

The maximum depredation to forests is caused by the food requirement of man by bringing more areas under cultivation and providing better irrigation facilities. Very frequently planners are faced with the dilemma of giving precedence to developmental activities or otherwise.

Among the government agencies, mining and irrigation departments of various states are the biggest beneficiaries contributing to depletion of forest and wildlife by reducing their home (environment) and food. The mining and irrigation departments should contribute or yearmark certain fixed percentage of their revenue towards afforestation of the area. The mining areas should be worked with the concept of long range management and once the mining operations stop in a particular area it should again be brought under forest cover.

Poaching:

A number of acts to deal with this and allied matters are on record. Under any circumstance absolute eradication of this nefarious activity is unthinkable. The Zoological Survey of India has in recent years come out with three publications (Director, Z.S.I., 1981; Mukherjee, 1982 and Tikader, 1983) enlisting endangered/threatened species of Indian fauna. Frequently we come across news items dealing with seizure of wildlife and their product like skins, ivory and other products. The Convention of International Trade in

Endangered Species of Wild Fauna and Flora (CITES) aims at total ban or regulation of international trade in endangered species of wild fauna and flora.

Public remains in dark about the punitive action being taken in such cases. It appears that our wildlife acts do reduce the poaching but they are not producing desired effect. One of US (P.D.G., 1983) has suggested establishment of a machinery on the lines of Fish and Wild Life Services of the U.S.A. in our country. A serious consideration to this proposal is needed. Madhya Pradesh State Forest Department has given a good lead to invoke the Indian Forest Act 1927 under which the property used in connection with the forest crimes can be forfeited by the Government. It is an attempt in the right direction and should be followed in other States also.

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Blackbuck of Gujarat

By

S.K. SINHA, I.F.S., C.F. AND I.K. CHHABRA, A.C.F.

Introduction

The Blackbuck (*Antelope cervicapra*) is a truly indigenous antelope and is the sole representative of the genus in India. It is a graceful animal, which with its striking colour and beautiful spiralled horns, which may reach the shoulder height of the animal, presents a picture of elegance hardly equalled by any other antelope in the world. This exclusively Indian animal is perhaps the most beautiful of all its kind.

In Hindi the animal is named as "Krishnamrug" and in Gujarati it is called "Kaliyar."

Mythology

The Indian blackbuck has been a part of Indian culture as well as natural heritage for countries.

It is a general belief that blackbuck drives the Chariot of Chandra, the moon god, Hence the animal has moon like white circle ground its eyes.

In several places of India, like West Rajasthan, this antelope is worshipped because of its name Krishnamrug and they believe that it is a favourite Mrug of God Krishna or due to its colour which resembles that of Krishna.

In Saurashtra and other places of Gujarat, people consider it a holy animal because of its innocence. Even if this animal enters into the field, the farmers simply drive it away. They never shoot it.

The local Muslim mythology also considers it a holy animal. It believes that Kaliyar also remains on fast (Roza) on 27th day of the Ramzan month.

Present Distribution

The blackbuck once ranged widely in the plains and the deciduous forests of India, but destruction of forest and merciless hunting has made it rare.

Now it is found only in a few pockets of semidesert country of West Rajasthan, Kutch and coastal areas of Saurashtra in North India to coastal areas of Andhra Pradesh and Tamilnadu in South.

DESCRIPTION OF THE ANIMAL

Appearance

Young blackbuck is brown-backed. It gets steadily darker as it grows older till, at maturity an adult buck looks as if black ink has been poured over its back. The jet black lining and white ventral portions including the chin, and the circle around the eyes of the male buck, sets it apart from all other animals. The blackbuck is a superb specimen of evolution with sleek and extremely well muscled body.

The female of the species is a pale brown and white in colour, hornless with a conspicuous flank bar.

Size

A well grown buck stands about 80 cm at the shoulder. Its average weight is about 30 kg. The north Indian bucks (i.e. of Gujarat and Rajasthan) are bigger in body size than the bucks found in South India. Female is slightly smaller in size and weight.

Horns

The steel black coloured horns are about 45 to 60 cm long and beautifully spiralled. Only males show the spirally annulated horns characteristic of this species. In the yearly buck, the horns are without a spiral. In the second year a large open spiral is developed. The full number of spiral twists is attained with the dark coat about the end of the third year. Although 3 to 4 twists is average for the spiral in adult horn, but both the number of twists and tightness of the spiral vary within every population. It is found that the horns of blackbuck are longest in the North and shortest in the South. Horned females are occasionally but rarely met with.

Colour

The male buck and female (doe) have different colours. Female and immature male bucks are tan with white on the nose and throat, white inner pinnae, white rings around each eye and white under parts on lower neck, chest, inner legs, belly, rump and underside of the tail. A pale streak runs along each side of the body and there is a dark spot above each hoof.

Adult males exhibit a darkening of the pigmented areas which adds to the contrast with the sharply demarcated white areas of the coat. In some males, the dark areas actually turn black.

The darkening of coat varies in intensity. In South India, the adult buck is rarely black, while in Velavadar (Saurashtra) absolutely black pigmented area is met with. In

general, there is a fading in the richness of tone during hot weather and an increase in its velvety lustre after the rains.

Albinos

Sometimes totally white coloured are noticed in Kutch and Saurashtra. It is not a separate species, but only a congenital anomaly that involves a diminution or absence of colouring agent in the skin, hair and even in the eyes. The offspring of such albino may not be albino, but with colours of a normal blackbuck.

About 6-7 years before one albino was noticed in Velavadar Blackbuck National Park, which was killed after by a wolf. At present 3 albinos are recorded in Dhakaniya Vidi of Botad Taluka of Bhavnagar District.

Life Span

On an average it lives for 10 to 15 years.

BEHAVIOUR

Habitat

The blackbuck is an animal of open terrain, a species of the thorn and grassy lands. They are able to tolerate direct sun better than any other wild ungulates and are more diurnal in their grazing and foraging.

Herd Formation

The combination of terrain and vegetative profile have a pronounced effect upon herd size and composition among blackbucks. In brush of openings herds tend to remain small whereas, in the open plains many animals are drawn together forming large herds. Usually they live in herds of 20 to 30. Sometimes composite herds including as many as 600 animals, as observed in Velavadar National Park. A composite group or herd consists mainly of females and fawns with few sub adult and adult males. The leadership of a herd is usually vested in an old and vigilant female. Female with their fawns never move solitary. While solitary male, are observed far away from the herds.

Adult and old males with dark black coat are usually found in groups and remain separated from the composite groups and forming a separate territory.

Feeding and Diurnal Activities

They chiefly feed on grasses. Sometimes on cereal crops when agriculture fields are adjacent to their areas. During summer, when there is scarcity of grass, they used to eat pods of *Prosopis juliflora*.

Grazing period is mostly morning and afternoon to late evening. They start raising from their last resting period of the night with the first light of dawn. By sunrise they

drawn together into grazing groups and become engaged in their most obligatory grazing period of the day. This gains them the advantage of any dew on the grass. Mother feeds its fawns soon after rising and fawns of sufficient age may also sample the grass after nursing. Territorial bucks graze about within their borders.

A mother shows period of low intensity grazing in the close vicinity of her bedded offspring, as it raises her head so often to look alertly around, to observe a view of her surroundings.

When the day becomes warmer, they start resting on the ground. Only one or two animals are found standing here and there. They resume their grazing activity in afternoon and continue up to the evening. When they go for agriculture crops, they usually feed at night, when the fields are unprotected. It prefers wheat and cotton seed.

One of the dominant themes of the blackbucks life is their movement. Animals keep moving as they graze. From sunrise to sunset the average distance they travel is about 7 km.

Like other hoofed animals that live in arid environments on forage and low food value, the blackbuck can probably recycle nitrogen within its body instead of excreting it in urine. This not only conserves water, it also enables the animal to survive on food with low protein content.

Drinking Water

They have no fixed time for going to water, but usually morning and evening. It is very fast in drinking water and usually takes only one bout with the maximum time of 30 seconds.

REPRODUCTION

Mating

Blackbuck breed at all seasons, but mainly between February and March when the males are seen fighting with each other for the possession of the doe. They are particularly pugnacious at this time. A buck then struts about with a peculiar mincing gait, uttering short challenging grunts. Another interesting feature is that during courtship activity it walks with its head raised high as if in defence. At this time its horns lie along its back and face glands wildly open, which secrete specific fluid that attracts females.

The male may desert his harem taking a favoured doe with him. Fighting between two males produce a cracking sound due to striking of horns. It lasts for a period till one of them get tired and runs away. The winner will chase him for some distance and then leave.

TERRITORIALITY AND 'AKHALI KORS'

Territorial males from essential segment of the blackbuck population. They are breeding bucks. These males make their territory by its dung piling at a place and urinating around the boundary. These resting places are locally called "Akhali" areas, and are frequented by their users (Kors) the blackbuck males. Hence called "Akhali Kor" areas. Due to continuous use of these areas, no grass comes up, hence "Akhali" can be marked from a long distance. Dung pile is a major feature of blackbuck territories created by the animals themselves. In a 'Akhlikor' area with high density of males, the boundary of one male territory touches with another. On an average one male occupy an area with 10 metre diameter. In Velavadar, Akhalis are also marked with growth of *Prosopis juliflora* seedlings growing from the dropping of the buck.

Despite seasonal peaks in sexual activity, at least a few females are likely to become sexually receptive in any month. Only the territorial bucks maximize their chance for completing the mating ritual by maintaining a space clear of rivals. Both adult males in all male associations and adult males in mixed groups are physically capable of breeding, but competition from other males prevents uninterrupted courtship.

The akhalikors, the vigorous territory holders frequently engaged in displays and fights with rivals. Like all territorial blackbucks, the akhalikors leave their territory for brief periods each day to feed.

Gestation period

The gestation period for bucks is about five and half months. One or two young usually one, are produced at a time. The mother usually conceals in the grass, but it gains strength rapidly and soon rejoins the herd with her fawn. The new borns are generally dropped just before or after the rains and benefit greatly from the lush grasses that spring up during the wet season.

Fawns display amazing agility and within a few weeks may be seen wandering short distances from their mothers.

Speed

Blackbuck is considered to be the fastest animal in the world. These are known not only for their handsome features but also for its lightening speed. The buck can on an average runs 60 kms per hour when alarmed. The buck first gallops and it rises up to 2.5 metres and leaps across up to 6 metres at a stretch. Their graceful leaps are extremely athletic and hoof prints between bounds measures up to 7 metres.

At the sign of danger, does alert the herd and first one then another engages in vertical leaps with all four feet in the air, this action conveys excitement and the animal quickly moves away from the source of threat.

Predators

The Cheetah, also called the hunting leopard, was the blackbucks, principal predators. Both species are adopted for an open plains habitat. Since the Cheetah extinction in India in the early 1950s, the major blackbuck predators are Jackals, Wolves and Pariah dogs. These canids can full down even full grown bucks. The other predators of lesser importance are foxes and eagles. These small animals are said to prey mainly on young fawns.

The animal has one peculiar habit. Whenever it is chased by any predator or poacher, it runs across in front of the chaser to reach on other side. This is why despite of its high speed the animal is usually killed.

CONSERVATION OF BLACKBUCKS IN GUJARAT

Distribution of Blackbucks in Gujarat

In Gujarat State blackbucks are found in pockets of North Gujarat, Kutch and districts of Saurashtra.

In North Gujarat:—It occupies a semi-desert area around Kadi Taluka in Mehsana district.

In Kutch:—It occupies semi-desert plains of Little Rann and coastal plains of Big Rann of Kutch.

In South Gujarat:—Blackbucks are found near Vadodara in Sunderpura village.

Saurashtra:—Blackbucks are now mostly found in scattered groups in the coastal plains of the Saurashtra region. However, except in the coastal area known as "Bhal" the number of animals found in different pockets is very small. In the Bhal area of Bhavnagar of Dhandhuka and Botad Talukas large herds of blackbucks still occur. Some blackbucks are found near coastal areas of Junagadh district.

The distribution of blackbucks and their approximate population (1985) is shown in the table:—

<i>District</i>	<i>Place</i>	<i>Approximate population</i>
Mehsana	Near Kadi	75
Kutch	Little and Big Rann of Kutch	300
Bhavnagar	(a) near Velavadar with surrounding area of Mewasa Mithapur and Bovaliali	2000
	(b) Near Victor Port	40
	(c) Dhankaniya Vidi in Botad Taluka	350
Surendranagar	Near Limli	150
Amreli	(a) Near Rajula	40
	(b) Near Damnagar	20
	(c) Near Lathi	15
Junagadh	(a) Near Jhajmer	25
	(b) Near Kotda	50
Vadodara District	Sunderpura	150
	Total ...	3295

CONSERVATION

It was only after formation of a separate state of Gujarat in the year 1960, that conservation of Blackbucks gained momentum.

After taking several efforts by the Government and Department of forest for the protection and providing suitable habitat to the blackbucks. We are getting positive results. To protect large herds of blackbucks found around Velavadar, from decimation by poachers, a sanctuary for blackbuck of 890 hectare of the Government Vidi area at Velavadar was established in the year 1969 and in the year 1976, the whole of the Velavadar Vidi area admeasuring 1783.38 ha, was constituted into a National Park.

Velavadar Blackbuck National Park and other sanctuaries of Gujarat have good population of blackbuck and their number are increasing day by day. But blackbuck's living outside the Sanctuary can not be fully protected and thus there numbers are decreasing.

Following problems are creating adverse effects for blackbucks in Sanctuary areas as well as outside of it:—

(a) **Reduction in habitat due to agriculture etc.**

Blackbucks need an open grasslands without any disturbance around it.

Extension of agriculture land in the natural home of bucks and interference of human being in the form of Residence, traffic, grazing of domestic cattles, have created adverse effect on the bucks.

The vast grasslands a natural home for bucks are now day by day confining into small pockets. Such small areas are unable to support the population of bucks, hence it is the most serious cause for the reduction of population of bucks.

(b) **Poaching by Dafers**

Dafer is a community which is involved in criminal activities, mostly the poaching of wild animals and selling of meat and valuable articles.

Blackbuck is a handsome animal. It is killed by Dafers due to its meat, valuable skin, and prized horns.

Vagharis is the another community, do the same job. Their activities are mostly at the boundaries and surrounding areas of the Sanctuaries and National Park.

In Velavadar National Park, poaching is almost checked due to patrolling round the clock. But in the surrounding areas still killing of blackbucks is noticed.

(c) **Spread of *Prosopis Juliflora* in the National Park**

As recently as 20 years ago, the Velavadar area was predominantly an open plain. Today an exotic tree, *Prosopis juliflora* introduced into Gujarat about 30 years ago is threatening to change Velavadar into thorn forest. This tree took hold at Velavadar during a promotion some 12 years ago and now rings the park.

Blackbuck eats its pods during summer, when grasses are in scarce, but this extra source of protein cannot offset the loss of grassland habitat. Even though blackbucks often use shade of this tree on hot days when conveniently available, but they are adopted to thrive without it.

Forest department spends good amount of money to have workers cut *Prosopis* and chop its root out of the blackbuck grazing land. Although costly, the present programme of eradication of the exotic tree should be continued so as to save the natural habitat of bucks.

(d) **Grazing by Domestic Cattle in the National Park**

Since 1967, when the sanctuary was declared as National Park, the area is absolutely closed for grazing by the cattle. As only one third of the total National Park area has good grasses, while another 1/3rd area is covered with *Prosopis* and rest 1/3rd area is saline zone, where nothing is coming up.

Hence the only available grassland area cannot support the whole population of bucks. Thus park is over grazed. Encroachment by domestic livestock aggravates the situation. Although such violations are more common during the monsoon when the cattle owners of neighbouring villages have all their cattles at home.

Now a days continuous patrolling all around the boundary of park is done to check the grazing by cattle.

(e) **Predators**

The major blackbuck predators at the Velavadar National Park are Pariah dogs, Jackals and Wolves.

Pariah dogs are presently the major blackbuck hunters at Velavadar. They make regular morning and evening hunting trips. Very young animals are the easiest victims but adult animals are also caught.

While with only light predation pressure from jackals and wolves. Two groups of total nine wolves is noticed in this park.

(f) **Natural Calamities**

The climatic extremes are normal for the Bhal. Every second year is apt to bring a drought, but some years cyclonic storms accompanied by heavy rains flooded the area.

Being slightly lower than its surroundings, Velavadar can be knee deep in water that stands for 10-15 days.

There have been two such major calamities in the last decade. One in year 1976 and another 1982. When the damage to the population of blackbucks was heavy.

To avoid any damage further in National Park, raised platforms and raised forest roads within the park are now constructed which give solid base to the bucks during flood.

FORMATION OF VELAVADAR BLACKBUCK NATIONAL PARK

Historical Background

Velavadar Blackbuck National Park is a former Vidi (Grass gathering area) of the rulers of Bhavnagar State. During the "State time" the blackbuck had much more land at their disposal. Their grazing land also included the adjoining Mithapur area which was a private grazing land for the Maharaja's cattle. Although scattered groups of blackbuck occurred throughout the Bhal, the really large aggregations formed mainly on the Velavadar-Mithapur grasslands, and this was declared a sanctuary under the Maharaja's rule to protect the herds.

Before independence 15,000 blackbucks were estimated in the Bhal area. After independence, severe drought and famine forced the Saurashtra Government into allowing wildlife to be killed on sight in order to protect crops. Blackbuck slaughter in the bhal began. New roads for bus transport opened the area to poachers coming from as far away as Ahmedabad, Jaipur and Bombay. By 1966 commercial meat hunting had reduced the Velavadar-Mithapur population to about 200 animals.

Declaration of Sanctuary

Finally in 1969, a sanctuary of 890 ha was established at Velavadar and small staff is posted there. Due to protection and co-operation of local villagers, the population of blackbuck became approximately 2000 by the year 1974.

Declaration of National Park

In 1976, the sanctuary was upgraded to a National Park of 1783.88 ha. The same year, a cyclone accompanied by heavy rain and wind flooded the park and at least 923 blackbucks died.

The first official census in May 1977, found 1554 blackbucks inside the park plus another 122 in the adjacent buffer zone.

In February 17, 1980 an additional area of 1624 hectare of buffer zone is added to the park area. Thus total area of the park became 34.17 sq. km.

The National Park affords an excellent opportunity to study the behaviour of Blackbucks and their adaptability to climate changes from time to time.

Situation of the National Park

The National Park is situated at a bout 70 km. Northwest of the Bhavnagar city.

It can be approached by two ways.

One is through coastal highway from Bhavnagar to Ahmedabad. It is a shortest route to reach the park. Through this route the total distance from Bhavnagar to Velavadar is 48 km.

Second route is through Bhavnagar—Ahmedabad State highway. At 46 kilometre stone from Bhavnagar, a road turns to Velavadar National Park.

Nearest Air port is Bhavnagar.

Facilities

A forest lodge (Kaliyar Bhawan) with five suits is situated in the National Park. Catering facilities are available if intimated in advance.

Kaliyar Bhawan (Blackbuck House) is admirably situated, while being close to the park boundary and thus facilitating access, at the same time as minimising disturbance within the park. The lodge still offers visitors a guaranteed view of the most spectacular segments of the blackbuck population, the territorial males and the all male herds.

A binocular is also provided to the visitors to feel they have been close to the animals.

A photo tower at the middle of the park is situated, from which buck activities can be observed and photographs can be taken.

Raised road:—A raised road around the park and in the middle of park linking the visitors lodge and phototower makes the visitors to have an easy look of the animals, without disturbing them.

Physical features of the park and presence of blackbucks

We can devide the whole park area into three parts from north to south.

The northern most portion of park is flat, unobstructed grassland. It has several edible grasses which are preferred by bucks, hence proved ideal home for them. The most favourable grasses for bucks grow here are:

Jinjvo (*Dichan thium annulatum*)

Dharat (*Cynodon dactylon*)

This is the part where most of the animals are staying. This part can be further divided into two:—The western portion is mostly occupied by the adult males and have “Akhalis” areas. The eastern half is mostly occupied by females, youngs and few males.

The second and middle portion separated from first by a tar road, has a dense growth of *Prosopis juliflora*, leaving only brush openings. Few animals, mostly adult male bucks temporarily visit this areas, usually at the hot day time.

The third and last southern most portion is a saline zone, where except few patches of prosopis, nothing is coming up. Animals occasionally visit this area.

Water holes

Nine water holes are made at intervals, within the park in which water is filled through pipeline. These water holes provide sufficient water to blackbucks.

Points of attraction in the park

(1) A vast open flat grassland with unobstructed vision on which hundreds of blackbucks moving freely, is a very attractive feature of this park.

(2) It gives pleasure to see a graceful animal with its striking colour and beautiful spiralled horns, especially contrasting black and white coloured adult males spread over the park produce a unique picture.

(3) There are about 25 territories (the Akhalis) within the park, where territorial males are inhabiting. One of the most prominent “Akhalis” is about 300 metres South of the visitors lodge, where the activities of breeding bucks (Akhalikors) can be observed. The special calls in the form of uttering sound by blackbucks can be heard.

(4) Fighting amongst males:—It is very interesting to see fighting between males which produce cracking sound due to striking of horns. The fighting usually lasts for few minutes.

(5) Running and leaping:—It is an eye catching activity to see bucks in running and leaping. The galloping especially of fawn is very attractive. The fawns run less and gallop more when following their mother and during the play with other fawns. During leaping, its hind portion rises more and resembles with the hare.

(6) Other wild animals:—Other wild animals can be seen in the park are:—

Indian Wolf

Indian Desert Fox

Jackal

Desert cat

(7) Birds:—It is also a good place for bird watching. The birds which are commonly seen (October-1985) here are:—

Indian Myna

Crested lark

Black bellied Finch lark
Rufoustailed Finch lark
Steppe Eagle
Pale Harrier
Blue Rock Pigeon
Black Drongo
Little Egret
Indian Reef Heron
Hoopre

Grey shrike
White stork
Black necked stork
Curlew
Yellow throated sparrow
Rose Winged Parakeet
Bushchat
Rosy paster
Red wattled Lapwing

RESEARCH ON BLACKBUCKS

Works done so far

(1) A research project on the blackbucks was done under Joint United States-Indian Blackbuck project, by Elizabeth Cary Mungall, from California with co-workers Mr. B.H. Patel and N.L.N.S. Prasad.

(a) The object of this project was to observe native Indian Blackbuck population in order to assess conservation and management practices.

(b) Comparison of physical characteristics and behaviour of blackbucks found in Velavadar National Park, Point Calimere, Tamilnadu and introduced blackbuck loose on Texas Rangeland.

(2) Research work is done by Shri K.S. Ranjeetsinghji on Blackbucks at Velavadar for his Ph.D. dissertation.

(3) A project work is done by Dr. S.C. Pandey, Saurashtra University "On Determination of Carrying capacity for blackbucks" at Velavadar National Park, but the project report has not yet been published.

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Incidences of intraspecific fights and cannibalism among tigers in Kanha National Park

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Tigers have been reported to fight with other tigers. The seriousness of the fight varies depending upon the conditions. They may be injured, sometimes seriously, later resulting in death of one or both. At times the fight ends in instantaneous death of one of the tigers and in such cases the winner tiger even eats the dead tiger. Tiger cubs are also killed by adult tigers and they are often eaten up.

There have been reports of fights between adult males, adult females, adult male with female and adult male with cubs. The young cubs are hardly empowered to face the adult tiger. They are simply killed and eaten up. But the grown up cubs do give a fight to the adult male.

The exact reasons for this habit of tigers are precisely not known. Perhaps this reflects the sense of dominance of the tiger over his own conspecific. The plausible reasons of fight seem to be common kills, defence of territory, possession of estrous females by males to produce their own progenies and intolerance (McDougal, 1977). Killing the cubs, automatically puts control over the population of tigers. Limited number of cubs have better chances of survival. On becoming adult they have better chances to occupy larger territories than with more number of cubs growing to adulthood.

There are several records of fights between tigers. Baker (1888) mentioned that he has shot two large males which were "grievously injured" while fighting. Sanderson (1878) recorded that a large tiger was killed and half eaten following a fight which resulted from his being attacked by another tiger while on kill. Rice (1857) described that two large males were heard ferociously roaring during the night near a town. Next day morning both tigers were lying dead a short distance apart. Brander (1923) quoted similar example of fight between two males very near to his camp. During a night the roaring of one tiger was taken up and answered by another. The two animals approached each other and a

terrific fight ensued. Next day morning he visited the spot to confirm the scene. Six weeks later he shot one of these tigers as was obvious by the marks on its head and body. There is even fighting between male and female. Eardley-Wilmot (1910) heard two tigers fighting on and off during the night. The next day morning a tigress was found with "somewhat severe" injuries to the chest and throat. The state of her muddy coat indicated that she had probably been pinned down and "worried". The male tiger, still in an "evil temper" was found not far away. Similar incidence was witnessed in Kisli Range in February 1984, when the radio-collared female tiger with her grown up male cub fought with the territorial male, but ending with only light injuries. Sometimes the estrous tigress attracts more than one tigers and on such occasions, males have been known to fight with each other. Once Forsyth (1872) heard "a peculiar long wail, like the drawn-out mew of a huge cat". This was answered by "a deep tremendous roar", followed almost immediately by another, "pitched yet deeper in tone", indicating that the female has been answered by two different males". Marks of blood showed how genuine the combat part of the performance had been". A similar incidence was witnessed in Supkhar Range in June 1979, when the call of female was answered by two males. Hanley (1961) reported a fight in which three males were involved.

Several other incidences of fights among tigers have been recorded in Kanha National Park. An incidence of fight between two tigresses in May 1967 has been recorded. This tigress died after more than a week from the injuries sustained in fight. In another incidence a male tiger was seriously wounded in a fight with another male in February 1975. It was frequently observed till May 1975 when he eventually succumbed to his wounds (Panwar, 1979). In June 1983 a female has wounded a man near Sondhar Forest village in Kisli Range. Next day it was captured by immobilisation with drug mixture of 600 mg Ketamine and 250 mg Xylazine. It was seriously wounded with several wounds on shoulder, neck and all over the body. The tigress succumbed to her injuries. It was found that her both the shoulder bones were broken and there was injury in the skull near the occipital pit. The tigress might have been in combat either with its own conspecific or with a heavy wild boar. In the recent past, there have been two incidences of male tiger killing another male and five incidences of tiger killing and eating the cubs. Almost all the incidences have been witnessed by the author and are being described here in nutshell.

On 11th January 1982, when an International Workshop on "Techniques in Wildlife Research and Management" was going in Kanha National Park, an incidence of a tiger killing and eating another tiger has occurred in Deotalai area of Kanha Range in the Park. The Forest Guard, while patrolling the area, got the smell of some kill around and on

searching the area, found partly eaten dead body of a tiger lying in bamboo clumps, close to the road. We could reach the spot around 8 P.M. in the night. It was found that the dead body of the tiger was dragged about 6-7 metres from the place where it was seen by the Forest Guard in the day time and more portion was eaten from the hind quarters. There was fowl smell and maggots on the tiger's body indicating the kill to be of about last 48 hours. As we were observing the body, the winner tiger gave several drawn out "H-O-W-N" calls from about 200 metres away in the adjoining forest edge across the open grasslands. It seemed that the tiger was already eating the dead tiger and on our approach left the carcass and perhaps retaliated against our presence on the spot, by these calls. Next day morning pug-marks of a male tiger were found near the carcass and faecal matter which was full of fat and some tiger hairs, as was revealed after a microscopic study of these hairs. Since many persons visited the spot which was a kind of disturbance to the tiger, it abandoned the carcass after feeding for initial two days. It has consumed about little less than half the body. There were canine marks on the neck and skull. The skull was collected and cleaned. It was found that the cranium was crushed from the middle. This might have caused instantaneous death of the tiger due to severe brain injury. Perhaps this is the quickest way to kill the animal without prolonging the fight which might otherwise cause more wounds to either of the fighting tigers. The cleaned skull weighed 1627.7 g. Its length was 33 cm, breadth 22 cm and height was 15.5 cm. All the canines were in good condition.

Another similar incidence occurred on 31st January 1984 near *Thenga nalla* in Supkhar Range of the park. The dead body of the tiger was located by the fire watchers on duty in that area. It was already late in the night by the time we could reach the spot. The weather was cloudy and it was also raining lightly. About forty persons were posted to guard the dead tiger. These persons heard the calls of the winner tiger and even saw it around. The carcass was not eaten from anywhere. There were claw marks on the body and canine marks on the neck and skull. The body was blotted and started smelling but there were no maggots indicating the kill to be of about last 24-36 hours. Reddish liquid was oozing from the wound on the skull. The neck was broken. The pug-marks evidence on the spot revealed that one tiger came from the northern side and another from the opposite direction on the nearby road. Several pug-marks, scratches on the ground and fallen tiger hairs indicated a scene of ferocious fight to have occurred on the spot between two tigers. After killing, the dead tiger was dragged by the winner tiger towards southern side about 150 metres, crossing a small *nalla* in the open forest with tall grass, where the body was lying. This indicated that the deceased tiger was perhaps the one, who came from northern side. This tiger was not eaten for one day after having killed by other tiger. The winner tiger, however, was around the kill, and perhaps might have also eaten, had the dead body been not guarded. The body length was 270 cm including tail (97 cm) and shoulder

height was 106 cm. On cleaning the skull, it was found that it was crushed from near to atlas vertebra through which the putrid gray matter of tiger's brain was oozing out. This tiger might have also died instantaneously due to severe brain injury. The cleaned skull weighed 977.5 g and measured 26 cm in length, 21 cm in width and 13.5 cm in height. All the canines and nails were in good condition.

The Supkhar tiger was much smaller in size than *Deotalai* tiger as is apparent from size of their skulls. Both of these incidences are quite similar in mode of killing by crushing the skull and season of killing i.e. January which is also the prime mating season of tigers in the area. This indicates that fights might have occurred over possession of estrous females.

There have been incidences of tiger killing cubs and also eating them. Out of three cubs of a tigress, a male cub was killed and partly eaten by a male tiger on 17th June 1976 in Chuhari area of Kanha Range in the park (Panwar, 1979). Another incidence of tiger killing a female cub occurred on 6th January 1982 in Kanha Range in the park. This cub was seen with the mother in the previous evening. Next day morning, the cub aged about 8 months was found dead. When it was collected in the morning, the body was still warm, indicating that the death had occurred very recently. The body was not eaten. There were wounds of the neck which was broken. It weighed 17.5 kg, with body length 133 cm and shoulder height 65 cm. The cleaned skull was intact and weighed 329 g. It measured 22 cm in length and 10.5 cm in height. All the canines were intact.

In fact this tigress was regularly tracked by elephants and it was often seen with two cubs; one male and other female. The male cub was not seen since about a month back. It is suspected that this male cub was also killed by the territorial male. The body of the deceased, however, could not be traced.

A similar case of a 16 month old male cub having got killed by a territorial male occurred in Kisli Range of the park. A tigress, while making a porcupine kill, got a strong quill in the right jaw on 14th May 1982 in Banada Behra of Kisli Range. The quill was removed after immobilising the tigress with 700 mg ketamine and 250 mg xylazine mixture. The drug mixture was given intramuscularly by Tel-inject dart gun. The quill was 5.7 cm inside the jaw muscles and 12 cm outside. Antibiotic ointment was applied on the wound and long acting antibiotic was also given intramuscularly as a precautionary measure. A radio-collar was also tied in the neck of the tigress. Two days after, on 16th May 1982, the tigress littered four cubs, out of which one male cub died on 18th May 1982. It weighed 842 g. One more juvenile cub died few days later but its body could not be recovered. The remaining two cubs could grow older and were seen with the mother. The movements of this tigress were regularly radio-monitored up to April 1983, thereafter the

collar stopped functioning, probably due to draining out of its alkaline battery. The tigress was however, being regularly tracked by elephant trackers and often seen with both the cubs until September 1983 i.e. till they were 16 month old. In November 1983 onwards, the tigress is being seen with only one cub, the tigress is still having the dead radio-collar in the neck. With this much closer studies on the tigress, it is firmly ascertained that the cub has been killed by the territorial male. The body of the deceased cub could not be traced.

In yet another incidence which occurred on 1st February 1984 in Khairwadi area of Kisli Range, two cubs were killed and eaten by a territorial male. The tigress with both the cubs was seen in the afternoon of 31st January 1984. She killed a chital stag in tall grass of dry nalla bed. Then she went to nearby forest and soon returned on the kill with her two cubs aged about five months. But this time, the sun was set and therefore the elephants returned to the camp. Next day morning (1-2-84) both the cubs were found dead on the same place and mostly eaten. The chital stag was also lying nearby which was slightly eaten on the left thigh, otherwise it was intact. The dead cubs and the chital kill were so close that they could be photographed in the same frame. The bodies of both the cubs were lying close by. There were injuries on the neck and skull of both the cubs. Grey matter of the brain was oozing through the wound on the skull. The hind portions of both the cubs were completely eaten except the legs below knee. Shoulder height of both the cubs was 37 cm. One cub was bigger than the other and their remaining bodies weighed 5 kg and 3 kg respectively. The tongues of both the cubs were out and mouth closed. From the body size it can be inferred that the larger one should be a male cub and other female, while it may not be necessarily so. The skulls of both the cubs were cleaned. Both the skulls were found to be crushed from middle-left side of the cranium. Obviously, the death might have occurred instantaneously due to brain injury. The skulls weighed 58 g and 47 g and their dimensions were 13.5 cm length, 9 cm width and 6 cm height/12 cm length, 8 cm width and 5.5 cm height for both the skulls respectively. On the day of incidence one tiger could be seen quickly walking through the bushes, but it could not be ascertained whether it was male or female. There were alarm calls of langur and chital indicating the presence of tiger nearby. Next day, a male tiger was seen in the bamboo clumps about half kilometre from the place where the cubs were killed. This was the same territorial tiger who is suspected to have killed the 16 month old cub of the radio-collared tigress. Recently one case of cannibalism has come on record in January 1985. On 29.1.85 one tiger cub was found lying dead near Budbudi nalla in Kisli Range. The death of the cub might have occurred few days back as was evident from the putrified condition of the carcass. The dead cub was lying near the bank of nalla in opening among bushes where the grass was about 0.5 m. The body did not seem to have touched by any scavengers viz. jackals, crows, vultures etc. It was full of maggots. The skull was

collected which was found almost crushed to several pieces. The pieces have been assembled and displayed in Kanha museum. This is also a case of cannibalism by tiger, as is evident from the crushed skull of the dead cub. From these incidences, it becomes obvious that tiger kills its rival by crushing the skull and not by throttling.

The intraspecific fights and cannibalism do not seem to be observative behaviour in tigers because tigers seriously wounded after fights, having succumbed to their injuries after several days, did not show any untoward behaviour with man. Despite of the deaths of tigers due to intraspecific fights and cannibalism, the overall population of tigers in the park shows increasing trend as is obvious from the census data. Tiger census data of the park, from 1974 onwards, which is done every alternate years are 49 (1974), 54 (1976), 66 (1978), 71 (1980), 76 in 1982 and 85 in 1984. Actually the number of deaths might be more than recorded, because it is practically not possible to record all the incidences. Such incidences are perhaps, in the process of stabilising their population to a dynamically static state where new recruitment to the population by way of births and elimination by such means as described above, would nullify each other in order to maintain the population at a stand still and at the same time fulfilling the requirements of tiger's nature of dominance to defend territory and transfer of own genes by way of possession of estrous females, to produce progenies, a selection for survival of the fittest.

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Birds Beetles and Natural History

By

S. MOHAMED OSMAN AMIR

As a practising falconer with many years of experience in the sport, I have witnessed with dismay, the gradual disappearance of many hawks and falcons, particularly falcons. From observations made in this connection, I am convinced that the "DUNG BEETLE" (*Stercorarius*) could possibly provide an answer to this general decline in the numbers of birds of prey. My assumption is based on empirical field knowledge and first hand experience with raptors.

Twenty years ago, here in the Doon Valley, few if any of the many captive hawks and falcons we retained for hunting, ever showed signs of parasite infestation. I remember in those days very rarely would it become necessary to deworm any of our trained hawks or falcons. During that period many kinds of hawks and falcons, both big and small could be amply seen in the neighbourhood. It is now a recognized fact that the dainty MERLIN FALCON (*F. Khiquera ruficollis*) has completely vanished from the vicinity. In 1973 a detailed and intensive survey by the author revealed the existence of one Merlin's nest in the entire Doon Valley. About thirty years ago these pretty falcons were quite common in this area, and I knew of three pairs of Merlins nesting not far from the city. Many more could be seen slightly further afield. The SHAHIN FALCON, (*Falco peregrinus peregrinator*) also very plentifully seen in the past has now been perilously reduced and all but vanished from the scene.

A few years ago I watched a SHIKRA SPARROWHAWK (*A. badius*) feeding off a lizard it had killed. This happened about a mile and a half beyond the Sulphur Springs, directly to the N.NE. of Dehra Dun, and some eight miles from the heart of the city. I noticed the hawk very reluctantly feeding, and bothering its prey. The impression grew that the hawk was not well. After having partaken barely a third of the lizard it abandoned the meal to fly away. Seeing all this I was very much puzzled. Not far away I discovered, on a massive mango tree, the SPIKRA'S nest with two tiny chicks in it. They were covered with down so they could have been only a few days old. After four days I revisited the site and when I got directly below the tree with the nest, much to my sorrow I found my friend the SHIKRA, lying on the ground and breathing its last. Having picked it up I was astonished at the poor condition the bird happened to be in. Within a few minutes it was dead. I later climbed the tree and to my anguish found both chicks dead; of starvation undoubtedly. The male bird was nowhere in evidence and, had perhaps met with the

same fate that had overtaken its ill-fated mate. Postmortem examination of the dead hawk disclosed HELMINTHS that were present in massive quantities. These unmistakably were responsible for its death. Lately I have lost three falcons and one BONELLIS eagle to these killer parasites. In all these cases postmortem investigation confirmed the cause of death to be due to the action of HELMINTHS. In one particular case it was seen that these worms had eaten their way through the duodenum of their host (a peregrine falcon) to appear in the airsack and the lungs of the victim as well. These killer parasites I found to be unsegmented worms having a cylindroid cross section. All such worms are mostly covered by the ORDER HELMINTHS.

It is an established fact that eggs by these parasites generally pass out of the host's alimentary tract with excrement to appear in pads dropped by bovine. On the ground they are embryonated and become infective. After passing through further stages they assume an eel like larval form. All such organisms act in diversified manners. They affect their host by blocking its bile duct causing a malfunctioning of the digestive system. They can erode the membrane lining of the intestines, sometimes to the point of perforating it. They give off toxins that enter the host's blood to attack its brain cells resulting in fits that invariably prove to be fatal. Sometimes worm, the sheer length of their huge size and numbers are capable of blocking the intestines, thereby causing death.

These indications have been detected by me mainly in birds of prey. Under normal conditions other birds are not much effected by these parasites. The reason for this is very simple. While out feeding, most birds other than hawks and falcons, generally pick up and swallow pieces of grit and small stone particles that are for long afterwards, retained by the feeder in its gizzard. These particles in due course get pulverized by being constantly rubbed against each other in the process of digesting food. Parasites that are caught in between these particles, are severed outright to be expelled with the mutings. It is nature's way of eliminating worms, a very effective bit of medicine indeed. In addition to this on reaction with chemical juices they also provide necessary calcium required by birds for egg building etc. etc. In the absence of better medicine I have often treated tapeworm infestation in my trained eagles by the administration of crushed rock mixed with little butter.

Hawks and falcons do not feed on gritty stone fragments. In addition all birds of prey are in the habit of throwing a cast of undigested feathers every morning. In this manner a stray worm can be brought up, and which if not expelled outright with the cast, will remain in the predator's crop. The lining in this organ very soon gets punctured by the action of the resident parasite and when this occurs, the host is doomed to die a lingering death. But we may argue, why this explosion of worm infestation? We will see that the infamous

pesticide D.D.T. is indirectly responsible for all this mischief. Added to all this the effects of worm infestation as seen in the case of dogs is in itself sufficient to render them infertile. This factor alone would ensure a reduction, to a great extent, in the numbers of predatory birds bearing internal parasites beyond normal proportions.

We know that dung pads or excrement of any sort if not disposed immediately, in the natural way by the action of dung beetles very quickly become breeding grounds not only for flies but for the hatching of HELMINTHS as well. With thousands of bovine around and dropping at least ten pads each, every day, in addition to other illimitable sources of filth supply such as human ordure, disposal if not promptly effected would naturally create extensive breeding grounds for the industrious HELMINTH.

Indirect development of HELMINTHS is bound to occur if in the infective state described earlier, an embryo is swallowed by, let us say, a starling that has been feeding on this source of supply. Once inside the intermediate host, the embryo undergoes very rapidly, some required growth stages, prior to infecting the final host when it is taken up orally with the flesh of its erstwhile host by some predator. I have a feeling that the successful transfer of any parasite to a new host is bound to bring about changes within the worm's structural and physical features. Changed environmental aspects could inhibit the growth and stunt the size of these parasites as compared to their original bovine borne ancestry. However these features are sometimes regarded by parasitologists to be inborn characters of certain species of worms. Thus we see that notwithstanding structural features, HELMINTHS are common to all, be they birds, beasts, or human beings. Yet another way to get infected by HELMINTH larvae, is for predators to eat such prey which harbours these forms in the grooves between the scales on their toes or at the base of their breaks where they get collected in huge concentrations whenever a bird forages for food through any potential source of parasite supply.

Once contaminated a falcon soon begins to betray signs of tiredness which show up in the form of, in the early stages, loss of breath after the least exertion. This is closely followed by a sharp drop in body weight, and later a total disregard for food. Towards the end and, in the last stages there is bound to appear in copious quantities blood in the mutes. In its last throes, the illfated predator starts having fits. This condition portends certain death.

Prior to the discovery of the awful pesticide with its awesome name of "DICHLORO—DIPHEYL—TRICHLOROETHAOE", nature had taken ample care to get rid of parasites by nipping this problem right in the bud. Dung Beetles "SISYPHYS RUBRIPES" responsible for the disposal of dung pads and other forms of excrement, worked in the soil directly beneath the droppings, forming tunnels into which they carried the stuff fashioned

into small balls, each containing the beetle's egg. In this manner all offending matter was promptly removed from the scene and before the everpresent parasite eggs got a chance to cleave/hatch.

Today the dexterous beetle is no longer in its element, for man with the use of his laboratory chemicals has been destroying huge numbers of these beetles. In some areas, as my own enquiries have shown, man is responsible for the beetle's virtual disappearance. Even otherwise, poisons such as D.D.T. have now been proved to be outright dangerous. Not being selective in their specific target, they pose great danger to all living organism. Dwindling numbers of beetles are, we find, unable to cope with a situation that daily grows bigger and bigger.

Beetles die and parasite flourish, increasing in astronomical proportions, resulting in the decimation of many species of birds of prey. With predatory birds fading away from the present day picture, there is bound to occur a multiplication in the density of the world's rodent population, bringing in its wake outbreaks of rodent borne diseases such as plague and so on.

Summing up, it will have to be understood that the elimination of the dung beetle does not simply pose a threat to the survival of birds of prey alone, but who can say to the welfare of entire living forms on our planet, for it is unusual in nature for any single influence to operate in isolation.

Do The Tiger a favour—Befriend the CHEETAL

YOUR HELP SUPPORTS :

1. Sponsoring of Research Projects on Wildlife.
2. Protection of Natural Resources and Environment.
3. Nature Camps.
4. Wildlife Films.
5. Educational Aids.
6. Nature Consultancy and Advisory Services.

Wildlife Conservation in Orissa

By

S.K. Patnaik¹

L.N. Acharjyo²

Only a few decades ago, the forests of our State were teeming with various species of wildlife. To meet the increasing needs of the growing population more and more forest areas were ruthlessly and totally destroyed for cultivation, industrialisation, irrigation and communication etc., thus depriving the wildlife of their food and shelter. Besides indiscriminate hunting, poaching, poisoning etc., are also responsible for the decline of wildlife from our forests.

The necessity of conservation of wildlife in the present day context in the State was felt in the later part of nineteenth century and one of the examples of this is "The Elephant Preservation Act of 1879". A few years after in the years 1888, hunting, shooting and fishing rules were framed for protection of wildlife. But in recent years various measures are being taken at different levels for the conservation of wildlife in our State. Some of the various wildlife conservation measures so far taken in recent years in the State of Orissa are briefly discussed here.

Constitution of Advisory Boards

There is a State Wildlife Advisory Board with the Minister of Forests, Orissa as its Chairman and officials, and non-officials as its members to advise on all wildlife matters of the State.

There is another board known as the Nandankanan Development Board with the Minister of Forests, Orissa as its Chairman and high officials as members for the proper, quick and co-ordinated development of the Nandankanan Biological Park, consisting of Zoological Park and Botanical Garden.

Implementation of Wildlife (Protection) Act, 1972

The Wildlife (Protection) Act, 1972 and the rules framed thereunder are in force in the State since 14th August 1984. This will go a long way in the conservation of the wildlife of the State. The Act is being strictly implemented in the State to prevent wildlife offences. As per this act, with the co-operation of the Railway Authorities, supply of sea turtles by train to Calcutta market from Puri-Konark coast has been totally stopped. Poach-

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ing of sea turtles from Gahirmatha coast of Bhitarkanika Sanctuary could be checked with the help of Coast Guards Organisation.

Creation of a Separate Wildlife Wing

A separate wildlife wing within the State Forest Department was set up on 3rd June 1976 to save the wildlife from rapid depletion and extinction as well as to check denudation of its habitats. The wing was headed by the Chief Wildlife Warden, Orissa, initially in the rank of Conservator of Forests. But at present it is headed by an Addl. Chief Conservator of Forests (Wildlife) with headquarters at Bhubaneswar. All the territorial and wildlife divisional forest officer and the Wildlife Conservation Officer of the State have been appointed as Wildlife Wardens. Some of the eminent wildlifers of the State have also been declared as Honorary Wildlife Wardens.

Another wildlife conservation division with headquarters at Chandbali (Balasore) has been created since 1980 for proper management of well-known Bhitarkanika Sanctuary. Four more Wildlife Divisions in the State have been created in 1985. One more Division under the Deptt. of Science, Technology and Environment has been recently created to manage the Chandka Elephant Reserve.

The staff of this wing would discharge the statutory functions enjoyed in the provisions under Wildlife (Protection) Act., 1972 and rules framed thereunder in addition to scientific management and development of wildlife areas of the State.

Wildlife Sanctuaries:-

For proper management and protection of some of the important wildlife, Sanctuaries have been established. At present there are 14 notified Wildlife Sanctuaries in the State for the conservation of important wildlife and they are as follows:

1. Satkosia Gorge Wildlife Sanctuary
2. Bhitarkanika Wildlife Sanctuary
3. Similipal Wildlife Sanctuary
4. Nandankanan Wildlife Sanctuary
5. Hadagarh Wildlife Sanctuary
6. Mahanadi Baisipalli Wildlife Sanctuary
7. Kotgarh Wildlife Sanctuary
8. Khalasuni Wildlife Sanctuary
9. Chandka-Dompada Wildlife Sanctuary
10. Sunabeda Wildlife Sanctuary
11. Kuldiha Wildlife Sanctuary
12. Balukhand-Konark Wildlife Sanctuary
13. Debrigarh Wildlife Sanctuary
14. Lakhari Valley Wildlife Sanctuary

Seven others are under active consideration of the Government.

Zoological and Deer Parks

At present there is a State Biological Park at Nandankanan consisting of Zoological Park and Botanical Garden. Besides there are deer parks at Raj Bhavan (Bhubaneswar), Harishankar (Bolangir), Kapilash (Dhenkanal), Chandipar (Balasore), Sunabeda (Koraput), Kuanria (Puri), Cuttack and at Rourkela.

The Nandankanan Biological Park is attracting nearly seven lakh visitors a year. These parks serve the good cause by creating awareness among the public about the conservation of the wildlife.

Training of Field Officers

For better management of the wildlife of the State, both in free-living state and in captivity, Field Officers are sent for training on Wildlife from time to time.

So far 18 Forest Officers have already undergone the different long or short courses in wildlife management, outside the State.

Two Veterinarians of the State have already undergone the certificate course on "Health care and disease management of wildlife in captivity and free-living state" at Indian Veterinary Research Institute, Izatnagar (U.P.).

Recently in May 1984 a training programme on wildlife management for inservice forest officers of the State was organised at Nandankanan for a period of 5 days.

Officers of the wildlife wing are encouraged to attend workshops, meetings, seminars and symposia on wildlife management.

Some Forest Officers and Research Officers have also visited Africa, Australia, Latin America and South-East Asia for study tours.

Wildlife Education

It is gratifying to note that the Utkal University has started a specialised course on "wildlife" at M.Sc. (Zoology) level from the session 1978-79.

Similarly a course on "Diseases of Wildlife" is being offered to M.V.Sc. (Veterinary Medicine) students of Orissa University of Agriculture and Technology since 1976-77.

Besides the subject of wildlife is taught to the trainees of Forest Rangers' College, Forester and Forest Guards' Schools situated inside the State.

The Wildlife Wing is providing all possible assistance to these courses.

Natural History Museum

The Natural History Section of Orissa State Museum, Bhubaneswar which attracts

large number of people everyday, helps in creating interest among the public about the nature, wildlife and their conservation.

Special Wildlife Project

For intensive conservation of some of the endangered species of wildlife of our State, a few special projects as detailed below are in progress.

(a) **Project Tiger:-** One of the eleven tiger reserves of the country was established in the year 1973 in Similipal forests (Mayurbhanj Dist.). There were only 17 tigers in the tiger reserve just before starting of the project in April-May 1972, but 1979 tiger census of the reserve indicates that the tiger population has gone up to 65. Work carried out on the world famous pet tigress "Khairi" by late S.R. Choudhury, Field Director has been recognised with the award of "Padmasri" by the Government of India.

(b) **Crocodile Project:-** Orissa is the only State in the country where all the three species of Indian Crocodilians are found. Their number were greatly depleted from our forests, and so this project was taken up for the first time in the year 1975-76. The Gharial conservation and research unit at Tikerpada (Dhenkanal) and the Estuarine crocodile conservation and Research unit at Dangmal (Cuttack) were established in the year 1975-76. The Mugger crocodile conservation and research unit was established later at Ramatirtha (near Jashipur in Mayurbhanj district). Under this scheme the eggs are collected from their wild habitats and incubated in artificial hatcheries. Then the hatchlings are reared to a length of over one metre for releasing into their natural habitats. At present incubation and/or rearing of hatchlings of all the three species of crocodilians are in progress at these three units.

The fourth unit of this project at the Nandankanan Biological Park envisages the breeding of the three species of Indian crocodilians in captivity. All the species have successfully bred here.

(c) **Sea Turtle Project:-** Extensive rookeries of the sea turtles are found in Gahirmatha sea coast in Cuttack district and Puri-Konark sea coast. This is a renewable natural resource of the State which has not been scientifically exploited. This project is investigating productivity and ecological parameters such as natural predation and devising methods to prevent such losses so that this species can be protected.

(d) **Chandaka Elephant Reserve Project:-** An Elephant Reserve, first of its kind in the country is being created over an area of 189 Sq. Kms. of Chandaka Forests at an estimated cost of 5.08 crores. This envisages closing of the area by means of deep trenches, electric fences and creation of fodder and water sources for not only the 56 elephants living

there, but also other smaller wildlife. A wildlife division has been created under the Deptt. of Science, Technology and Environment for this project.

Research

Research on various aspects of wildlife and their habitat is considered necessary for the successful implementation of any wildlife conservation scheme. Research on various aspects of the tigers in their natural habitat and the behaviour study of the famous tigress "Khairi" of Similipal Tiger Reserve is well known.

First stage of research projects on Gharial and Salt-water crocodile have been completed. Two Research Scholars of wildlife wing have been awarded Ph.D. degrees by Utkal University basing on their research findings. A number of research papers on the findings of the crocodile project have already been published in different reputed journals.

The study of pathological conditions and diseases of wild animals and birds in captivity is in progress in collaboration with Orissa University of Agriculture and Technology and the State Animal Husbandry Department. Besides, the study on various aspects of different species of wildlife maintained at the Nandankanan Biological Park is in progress. Research papers on the findings of these studies are regularly published in different leading journals of the country and abroad.

Breeding of Endangered Species

Breeding of endangered species of wildlife is an important aspects of any wildlife conservation programme. Therefore, attempts are always made for breeding and propagation of endangered species in captivity at the Nandankanan Biological Park. The park is successful in breeding some of the endangered species like tiger, white tiger, panther, black panther, leopard-cat, golden cat, blackbuck, four-horned antelope, Indian Lion, Indian pangolin, Indian python, gharial, mugger crocodile, salt-water crocodile etc. After meeting the requirements of the park some of these animals were also supplied to other Zoological Parks of the country.

Rehabilitation of Species

Rehabilitation of species in their natural habitat where they were known to exist earlier is one of the known methods of conservation. Rehabilitation of gharial in its natural habitat, the river Mahanadi of the Satkosia Gorge Sanctuary was done for the first time in the world on 9th April 1977 and so far more than 200 young gharials have already been rehabilitated in Orissa.

Similarly 125 young Estuarine crocodiles of Dangmal unit were released into their natural habitat of the Bhitarkanika Sanctuary. So far, 60 mugger crocodiles were also

rehabilitated in their natural habitat in the river Budhabalang in Similipal forests (Mayurbhanj District).

Wildlife Census

Census of different species of wildlife is essential to know the status of a species in a given area. Then only effective conservation programme can be planned. For the first time in May, 1972, the census of tiger was taken up in the State and this revealed that there were 142 tigers. The second tiger census carried out in the State in May 1979 revealed 173 tigers. This number has increased to 203 in 1984.

The census of black-bucks of Bhetonoi area in Ganjam district was conducted twice in May, 1973 and again in April, 1980. As per these censuses there were 523 and 485 black-bucks respectively.

Elephant census of Orissa was conducted for the first time in May, 1979 and according to this census there were 2044 elephants in our State.

It is proposed to extend the census of wildlife to other species of the State and to conduct the census of different species of wildlife at regular intervals to know their status so that effective conservation schemes can be planned.

Control of Wildlife Diseases

The wild animals and birds like the domestic livestock suffer from various infections and non-infectious diseases. At present there are two Veterinarians (Nandankanan Biological Park and Similipal Tiger Reserve) and one Livestock Inspector working in the Forest Department for the control and treatment of wildlife diseases. Another veterinarian of the State Animal Husbandry Department has also been posted at Nandankanan for the same purpose. The specialists of Orissa Veterinary College and State Animal Husbandry Department render their valuable services as and when required for the control of diseases among captive and free-living wildlife.

Publicity

Along with the rest of the country the wildlife week is celebrated in our State every year in the first week of October. During this week public attention is drawn through various medias like; radio, film shows, newspapers, magazines, pamphlets, essay competition among school children, meetings, etc., on the importance of wildlife in human welfare and the necessity for their conservation.

The State department of Information and Public Relations has produced a few films on forests and wildlife like 'Nandankanan', 'Princess Khairi', 'Forest of Orissa', and 'Birds

of Chilka Lake', Wildlife films are screened at different places of the State in different times of the year by the Forest Department and Information and Public Relations Department for creating an awareness about wildlife among the public. At Nandankanan, wildlife films are screened on all holidays for the benefit of the visitors visiting the Park. Posters, stickers, booklets and pamphlets are brought out frequently depicting the various wildlife of the State.

People's Involvement

It is an accepted fact that no wildlife conservation measure can ever be successful without the whole hearted support of the public in general and rural masses in particular. It is gratifying to note that due to the sincere efforts of the villagers of Bhetnoi, near Bali-padar in Ganjam District, a herd of blackbucks (485 as per April, 1979 census) are still surviving there. The preservation of large turtles in Golia in Ganjam and at Maneswar in Sambalpur District are other examples. Indeed such examples of keen interest in wildlife conservation among people are rare. Recently in November, 1984 a mass mobilisation programme for conservation of blackbucks of this area was organised at Buguda (Ganjam Dist.) to draw the attention of the public, both officials and non-officials about the necessity of conservation of blackbucks.

Since 1982 a society named as "Nature and Wildlife Conservation Society of Orissa" has been formed as per the suggestion of the State Wildlife Advisory Board. The main purpose of the Society is to involve the people from all walks of life in conservation of Nature and Wildlife of the State. The Society is holding symposias and film shows from time to time and bringing out a quarterly newsletter on nature and wildlife. There is a proposal to take up some specific wildlife projects independently by the Society..

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Fighting of Forest-Fires in The Twenty-first Century

By

AIR COMMODORE R.S. BISHNOI, A.V.S.M. (RETD.)

Prevention is better than cure holds good in all walks of life. Occurrence of fires is no exception to it: in fact this field demands greater adherence to this maxim than most others. However, certain fires cannot be prevented and have to be necessarily fought. These are fires in the forests caused by natural reasons. For example, lightning can initiate fire in the forests during dry season, or sparks can be generated, resulting in fire, by the rubbing of bamboos with each other; or rolling down of stones can give rise to similar phenomenon. Forest fires can also be caused by accidental throwing of a lighted match-stick or a bidi by workers, grass-cutters etc. In addition to the accidental man-made fires, there may also be occasions when unscrupulous persons may deliberately set fire to forests with a view to collect honey, oil-seeds etc. and for promoting rich growth of grass for the grazing of their cattle. In respect of the man-made fires, both accidental and deliberate, the endeavour must be to prevent them altogether, and this could be achieved by educating the people in the advantages of forests on the one hand and the ruin brought about by their destruction on the other, undertaking vigilance and enforcing stringent legislation so as to give deterrent punishment to those committing arson intentionally or accidentally. These measures are required as much now as in the Twenty-first Century.

However, the natural fires in the forests caused by lightning or friction of bamboos or stones will always take place, and there has to be an adequate fire-fighting organisation to combat forest-fires. In any fire-fighting organisation, there has to be, in addition to manpower and the required fire-fighting appliances, efficient vigilance against spread of fire, quick communication with the control room and speedy transportation of fire-fighting personnel and equipment to the area where they are needed. Forest fire-fighting appliance in our country so far, is by and large simple, namely, twigs of trees containing leaves by which fire can be beaten. Fire can also be controlled by starting another fire on the down-wind side, which creates a gap in the vegetation and fire does not spread beyond it.

The object of this piece is to familiarise the readers with a new mode of speedy transportation of fire-fighting personnel and equipment to the site where they may be required, namely, by means of drop with parachutes from aircraft. As the country progresses into the Twenty-first Century with greater availability of aeroplanes and technological resources, its use cannot be ruled out. In the United States of America, parachutists have been used for fighting forest fires for the last 45 years. They are known as 'smoke-jumpers'. A survey of their organisation would be of interest. For the first time a forest-fire was put out by parachutists

on July 12, 1940. Rufus Robinson of Kooskia (Idaho—U.S.A.) and Earl Cooley of Hamilton (Montana—U.S.A.) jumped out of a Ford tri-motor aircraft to extinguish a forest-fire in central Idaho. Since then smoke-jumpers have tens of thousands of parachute-jumps to their credit. As per available information till the year 1972, they had made over one lakh of jumps.

In the U.S.A., the smoke-jumpers are a part of the U.S. Forest Service. The major establishment of the smoke-jumpers, namely, the Aerial Fire Depot forms part of the First Region of the U.S. Forests, and (in 1972) it had 140 posts of smoke-jumpers. The Fire Depot is located close to Missoula in the state of Montana adjacent to Canada. Its jurisdiction of fire-fighting extends throughout the Western U.S.A. A detachment of the smoke-jumpers is located in Alaska also.

The American smoke-jumpers are volunteers, drawn not only from the retired parachutists of the U.S. Army, but civilians can also volunteer. Hundreds keenly seek the few vacancies that occur in any year. The service of smoke-jumpers is seasonal extending from April to October every year.

The training of smoke-jumpers is very rigorous. Cross-country runs and the usual toughening courses, with which parachutists in our country too are very familiar, forms part of the training. They are required to do seven jumps during training, which includes jumps with equipment. A smoke-jumper usually jumps with 50 kilograms of fire-fighting equipment. Apart from proficiency in fire-fighting, a smoke-jumper has to be good in map-reading and use of compass, since he may have to reach places where no man may have ever put his foot before. They have to jump over thick forests where helicopters cannot land.

A smoke-jumper in U.S.A. may have to make parachute-jumps six to ten times every year for actual fire-fighting. However as far as is known to the author, there has hardly been any fatal casualty in the parachute-jumps due to mal-functioning etc. of parachute. However, twelve smoke-jumpers were killed due to burning when they jumped in 1949 in a mountain ravine near Helena in the Arkansas State, and the winds changed their direction drifting them into fire.

In conclusion, I can only say that while I do not venture to say if smoke-jumpers are needed in our country or not, I leave it to the planners and foresters to weigh the advantages of constraints of this unique mode.

Kolleru Lake—Its Diversity and Avifauna

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Abstract

Kolleru lake is the largest freshwater lake of India with a variety of fauna including many species of birds. Among birds, many species of egrets, cormorants, jacanas, herons, ducks, teals, raptors etc. are found. Grey pelicans were once abundant here but they weren't sighted after 1970. The lake is threatened with pollution, aquatic weeds, increased human interference as intensive fishing activities and poaching as well as habitat destruction. Steps should be taken to maintain its sanctity and identity.

The Study Area

Kolleru lake is the largest freshwater lake in India situated in West Godavari and Krishna districts of Andhra Pradesh. The area lies between longitudes of $81^{\circ}-5'$ to $81^{\circ}-20' E$ and latitudes $16^{\circ}-32'$ to $16^{\circ}-51' N$. The lake has an area of about 901 sq. km. at + 10' MSL. Geologically, it is believed to be of recent origin formed by excessive silting of the Krishna and Godavari rivers, of an earlier lagoon separating it completely from the sea. The lake receives an inflow of more than 1,00,000 cusecs and its outlet to the sea is Upputeru river. About 15 drains and streams, channels empty in to the lake. The entire lake is shallow and has only littoral vegetation with no limnetic and profound zones. It is heavily infested with aquatic weeds which pose problems for pisciculture, navigation etc. (Seshavatham *et al.*, 1982). There are 46 Bed villages and 76 Belt villages with a population of 2,00,147 (as per 1981 census).

Pelicanry at Kolleru

Kolleru lake area was famous for Grey Pelicans *Pelecanus Philippensis* Gmelin, since a long time. Neelakantan (1949) and Gee (1960) described Aredu-Sarepalle pelicanry. Aredu village near Kolleru lake was the largest breeding centre of grey pelicans. Palmyrah trees provided nesting sites for them and villagers protected them (Krishnan, 1981).

But between 1880 and 1954, Kolamuru pelicanry in Kolleru tract had declined (Ramana Rao, 1983).

Grey pelicans left Kolleru area by 1970. All efforts to locate them at Kolleru went in vain except for stray reports of lone sightings (Ramana Rao, 1983).

Avifauna of Kolleru Lake

About 160 odd species of birds were sighted at Kolleru lake area during a period of study from March 1985 to August 1985 (Ramana Rao *et al.*). They are residents as well as migrants. The most significant are, Jacanas, Egrets, Waders, Storks, Herons, Ducks, Teals,

Cormorants, Raptors, Wood Peckers, Doves, Barbets, Babblers, Warblers, nocturnal and other passerine birds. The most abundant, however, are openbilled storks and Jacanas. Great crested grebe, which is rare in this region, was also sighted. Future observations may reveal more migrant species.

Fish Fauna

Sixty three species belonging to 29 families have been recorded at Kolleru (S. Dutt, 1983). They include carps, catfishes, eels, live fishes etc.

Vegetation

As the lake receives rich nutrients as effluents from the several drains that empty into it, the vegetation is luxuriant and about nineteen species of hydrophytes belonging to thirteen angiosperm families are recorded (Seshavataram *et al.*, 1982). Coconut trees are cultivated and hence are abundant in this area.

Management Problems

The lake is threatened with extinction by Pollution, increased human interference and habitat destruction. The largest pelicanry at Aredu-Sarepalle had been already destroyed. Large scale scientific studies are necessary to understand the complete ecology of the lake. The lake should be managed well such that its sanctity is preserved. Steps should be taken to protect wild species of birds, their habitat and food resources by declaring it as a bird sanctuary. We shall act NOW to save a beautiful waterfowl refuge so that it can be of great importance for Wildlife lovers and naturalists.

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Jungle Crow and Champa Tree

By

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Abstract

Amongst the birds, jungle Crow (*Corvus macrorhynchos* Wagler) appears to be the major consumer of the Champa (*Michelia champaca* L.) seeds at Dehra Dun. The Champa seeds pass through the digestive system of the jungle Crow without damage to the morphology of the endocarp and also without any significant effect on its viability. Obviously, in India, jungle Crow may be one of the major dispersal agents of Champa seeds. Seeds, collected from the trees and droppings of the jungle Crow, sown within two days of collection, gave 68.75 to 93.75 percentage of germination.

Champa (*Michelia champaca* L.) is a tall evergreen tree, usually up to 30 m height, occurs wild in India in the forests of eastern sub-Himalayan Zone from Nepal eastwards, along the foot hills up to 900 m; also in the Western Ghats from Kanara to Kerala, occasionally in the deep valleys cooled by perennial springs in the Tholkabad and Karimpoda Forests of Bihar. It is cultivated throughout India for its fragrant flowers and handsome foliage. Natural regeneration occurs in its main distributional zone viz. eastern sub-Himalayan tracts and Western Ghats. It produces large quantities of fruits and the branches droop with weight. One may refer Wealth of India (Anonymous 1962) for various uses of the tree.

In Forest Research Institute (FRI) campus, Dehra Dun, Champa is planted along the roadsides, where it blooms from April to July at intervals. Fruits ripen from the later part of July till the end of September. When the fruit ripens, the carpels dehisce dorsally and the seeds are exposed. Usually in each carpel 3-9 seeds are found. The mesocarp of the seed is white-fleshy and the epicarp is a deep orange-red skin. Within F.R.I. campus natural regeneration could not be seen.

In the middle of July, on casual observation, it was found that four jungle Crows (*Corvus macrorhynchos* Wagler) were eating something on the ground under one of the Champa trees. I thought that they might be eating carcass of some animal. On inspecting the spot, it was found that the Crows were eating a fruit (a bunch of carpels) of Champa. As the fruit was not fully ripe, the carpels did not dehisce and the Crows had opened the carpels with beaks and eaten some of the seeds. At this stage the epicarp of the seed was

light pinkish orange. Since then frequently observations on the feeding of Champa seeds by jungle Crows were taken.

From the beginning of August, when sufficient quantity of fruits were ripe, large number of Crows were seen on the Champa trees all along the roadside feeding on seeds. During August and September Champa seed appears to be one of the major feed of the jungle Crows in the area. Many other birds also feed on Champa seeds. However it was observed that the Crow tops the list as the major consumer of seeds and none else is a close second. The Crows were mostly feeding between 6.00 to 7.30 A.M. and 5.00 to 6.45 P.M. During these times very few other kinds of birds visit the trees. The trees in this area are medium sized and about 9-13 m height. As many as 36 Crows were seen feeding on a single tree in one afternoon. Sometimes an individual may feed continuously on the same tree up to half an hour. It is a common experience that in August and September one who passes through the road, where Champa trees grow, can not pass without noticing the deep coarse 'Caw' of the jungle Crows during 6.00 to 7.30 A.M. and 5.00 to 6.45 P.M.

The Crows usually sit on the branchlets and remove the seeds from the dehiscent carpels with their beaks and swallow. Whenever the carpel or the whole fruit get detached in the process of removing the seeds the Crow carries them to the branches and holds them with their toes and remove the seeds. Occasionally when the fruits fall on the ground they come down and eat on the ground.

In fact, the birds are interested in eating only the fleshy mesocarp. In the process of eating the mesocarp larger and medium sized birds (Crows, Mynas, Parakeets, Tree Pies, etc.) mostly swallow the whole seed, while very small birds leave behind the hard black seed. Thus Crow appears to be one of the major agency for the dispersal of Champa seeds. In spite of the fact that the number of very small birds visiting the tree for eating the mesocarp of the seed is more, the consumption is very low and hardly any seed is swallowed in the process. Thus very small birds do not play a significant role in the dispersal of Champa seeds.

Troup (1975) states—"A fair quantity of seed is destroyed by mice and rodents. Parrots and other birds also devour a large quantity of seeds when they are ripe. So at best, only a small proportion of the seeds actually becomes available for natural reproduction". Anonymous (1976) also state—"A fair quantity of seeds are destroyed by mice, rodents, parrots and other birds." Therefore to find out the fate of the seeds eaten by Crows search was made below a Champa tree for the droppings of the Crow. Only one dropping, little scattered, was seen with three seeds which were undamaged. As this method was not successful in collecting the seeds from the droppings, a Crow was caged

and fed with Champa seeds. On examining the droppings it was clear that only the outer fleshy mesocarp of the seed was digested and the black seeds came out through the digestive system without any morphological damage to the endocarp.

In order to find out the viability of the seeds, which came out through the digestive system, some seeds collected on 21.9.85 and 22.9.85 from the droppings of the captive Crow and equal number of seeds collected from the tree on the respective days were subjected to germination test. The fleshy mesocarp of the seeds collected from the trees were removed immediately after collection by squeezing and washing the seeds in water and then the seeds were dried in shade. Both the days collections were soaked in water for two hours on 23.9.85 and the floating seeds were removed. Of the remaining seeds sixteen each, from the collections of 21.9-85 (Ic-control; Ie-experimental), and twenty-nine each, of the collections of 22.9.85 (IIc-control; IIe-experimental), were immediately kept on a moistened blotting paper within a petry dish to observe the germination. Collections from the tree were kept as control and the collections from the droppings were kept as experimental.

The number of days for the first and last germination after sowing with the percentage in each case are—18 and 29 with 93.75% in Ic; 16 and 23 with 68.75% in Ie; 15 and 28 with 82.75% in IIc; 16 and 29 with 86.20% in IIe. In the petry dish Ie, which had the lowest germination percentage (68.75) the germination was completed within 23 days whereas in the other three petry dishes, whose germination percentage was high (82.75—93.75) it took 28 to 29 days to complete the germination. Norman (1971) recorded 82% of germination from mesocarp removed fresh seeds and first germination after 20 days of sowing with a germination period of 60 days. In our germination test, most of the seeds which did not germinate were attacked by fungus. It is obvious from the above experiment that the germination percentage is quite high when the seeds are subjected to germination within one or two days of collection from the trees or droppings. It is also evident that eating of Champa seeds by Crows neither damages the endocarp of the seed nor the seed viability, but only the outer fleshy mesocarp is digested and seed passes through the digestive system without any significant results on its viability. Thus the Crow appears to be one of the major factor in the dispersal of the Champa seeds to quite distant areas, because the jungle Crow is common along the main distributional area of Champa tree. Perhaps, the other birds (Parakeets, Tree pies, Mynas, etc.) which were found to devour the Champa seeds too, may not be destroying the seeds, like the jungle Crows, but helping in their dispersal.

Acknowledgement

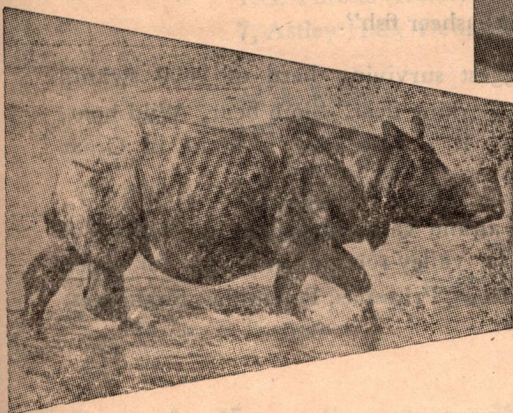
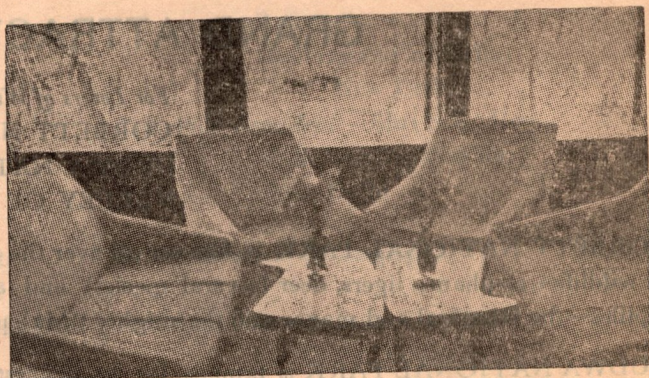
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